Optimization of early rehabilitation of patients undergoing cardio-surgical interventions – first-hand experiences

Optymalizacja wczesnej rehabilitacji pacjentów poddawanych zabiegom kardiochirurgicznym – doświadczenia własne

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Key words
physical therapy, respiratory therapy, exercise, education

Abstract
In this article, authors wish to share their experiences in work with the patients after cardio-thoracic surgery. Consecutive stages of early hospital rehabilitation and applied methods of therapeutic conduct have been described in detail. There are two main stages in cardio-surgical physiotherapy. Stage I – pre-operation preparation, stage II – early rehabilitation consisting of two periods: the first one run in an intensive care unit (ICU), the second one in a surgical unit. Along with the description of physiotherapeutic techniques, the most frequently occurring problems a therapist can face as well as the ways of managing them have been presented. The authors present certain dissimilarities in surgical rehabilitation of persons with different kinds of interventions on heart: CABG, plasty or the exchange of heart valve (aortic, mitral, more seldom tricuspid), the heart transplantation, operations of chest aortic aneurysm and abdominal aortic aneurysm, plasty of cervical arteries and corrective operations of cardiac defects. In the first stage the significance of patient's complex preparation for the operation highlighting the importance of the patient's education, which guarantees better post-surgical rehabilitation, is emphasized. In the second stage standard physiotherapeutic methods need to be aided by modern equipment: BIPAP Vision or Cough Assist. It has been observed that education, life quality assessment and support groups for patients after cardio-surgery have positively contibuted to rehabilitation process.

Słowa kluczowe
fizjoterapia, kinezyterapia, terapia oddechowa, edukacja

Streszczenie
W niniejszym artykule autorzy dzielą się swoimi doświadczeniami związanymi z pracą z chorymi poddawanymi operacjom kardiochirurgicznym. W szczegółowy sposób przedstawione są stosowane metody postępowania na poszczególnych etapach wczesnej rehabilitacji szpitalnej. Wyróżniono, w ramach fizjoterapii kardiochirurgicznej, dwa główne etapy. Etap I, to przygotowanie przedoperacyjne, etap II – rehabilitacja wczesna, składająca się z dwóch okresów: pierwszego prowadzonego na oddziale intensywnej terapii, oraz drugiego – na oddziale pooperacyjnym. Wraz z opisem stosowanych technik fizjoterapeutycznych wskazano najczęściej występujące problemy, z którymi terapeuta może się spotkać oraz przedstawiono sposoby radzenia sobie z nimi. Zaprezentowano również pewne odmienności w rehabilitacji pooperacyjnej u osób z różnymi rodzajami zabiegów kardiochirurgicznych, tj: zabiegów pomostowania tętnic wieńcowych, plastyki lub wymiany zastawek serca (aortalnej, mitralnej, rzadziej trójdzielnej), transplantacji serca, operacji tętniaków aorty piersiowej i brzusznej, plastyki tętnic szyjnych i korekcji wad wrodzonych serca. W ramach etapu I wskazano znaczenie kompleksowego przygotowania pacjentów przed operacją, podkreślając ważne miejsce edukacji chorego, która gwarantuje lepsze pooperacyjne usprawnianie, szczególnie ważne w trudnych pierwszych dobach po zabiegu. W drugim etapie rehabilitacji zaznaczono potrzebę wspomagania standardowych metod fizjoterapii stosowaniem nowoczesnej aparatury: BIPAP Vision oraz Cough Assist. Zwrócono uwagę na pozytywne efekty włączenia w proces rehabilitacyjny – edukacji, pomiaru jakości życia i tworzenia grup wsparcia dla chorych po operacjach na sercu.

Origins of the cardiac surgery rehabilitation should be sought among cardiac rehabilitation programmes that – in Poland – were designed by Askanas and Rudnicki[1]. With the search for new methods helping patients with cardiovascular diseases directing towards surgical treatment, kinesitherapy methods had to be modified as well as addition of physiotherapeutic methods exerting effects on the respiratory system was necessary. Step by step, therapeutic procedures are being adjusted to patient's needs resulting from the necessity of appropriate preparation for the planned cardiosurgical operation and to the problems occurring after the procedure.

As invasive methods of cardiovascular diseases therapy performed in

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many centres in Poland have become common, it seems helpful to discuss the rehabilitation management inevitable in such cases. Currently, physiotherapy is considered the constituent of an appropriately planned and conducted cardiac surgery. Presentation of the techniques and the associated experience of physiotherapy use in post-cardiac surgery patients may therefore be considered purposeful.

In the Department of Cardiovascular Surgery and Transplantology of the IK CMUJ (Institute of Cardiology at the Jagiellonian University Medical College) in Cracow, based on years-long observations and permanent cooperation between the physicians and physiotherapists, a three-phase process of rehabilitational management was designed that is applied in each patient scheduled in advance for surgery.

Consecutive phases of the cardiosurgical rehabilitation include: pre-surgery preparation and early rehabilitation comprising two principal parts: physiotherapy conducted in the intensive care unit beginning with the day of the operation until 1st or 2nd day after the operation, and physiotherapy conducted in the post-operation ward starting with 1st or 2nd day after the surgery until the discharge from the Department (usually until 7th day after the procedure).

Pre-surgery preparation

Patients are most often admitted to the Department one day before the planned surgical procedure. At this time, a physician, a psychologist and a physiotherapist meet the patients to inform them about the planned treatment and management procedures. This action is justified not only by the necessity of informing the patient, but also constitutes an initiation of a longer education process. During this pre-operation meeting, the patient has a possibility to actively learn about the activities he will be participating in immediately after the surgery. This is not unimportant, considering that during the day "0", immediately after the extubation, a strong pain and the effects of anaesthetics, albeit gradually decreasing, may frequently prevent the introduction of subsequent elements into the therapy and the exaction of patient's performance of these tasks. An earlier instruction of the patients during the post-surgery rehabilitation course and teaching the exercises used during this process make it easier for the patient to cooperate later on. The patient, in spite of intensive emotions and a multitude of new information and stimuli, he is "bombarded" with, more easily understands commands and performs the tasks more accurately after the operation provided he had been familiarised with them earlier. Thus, the reason for the pre-operation meetings with the patients involves expectation of a higher quality of the therapy and of cooperation with the patients during the difficult, first days following the surgery.

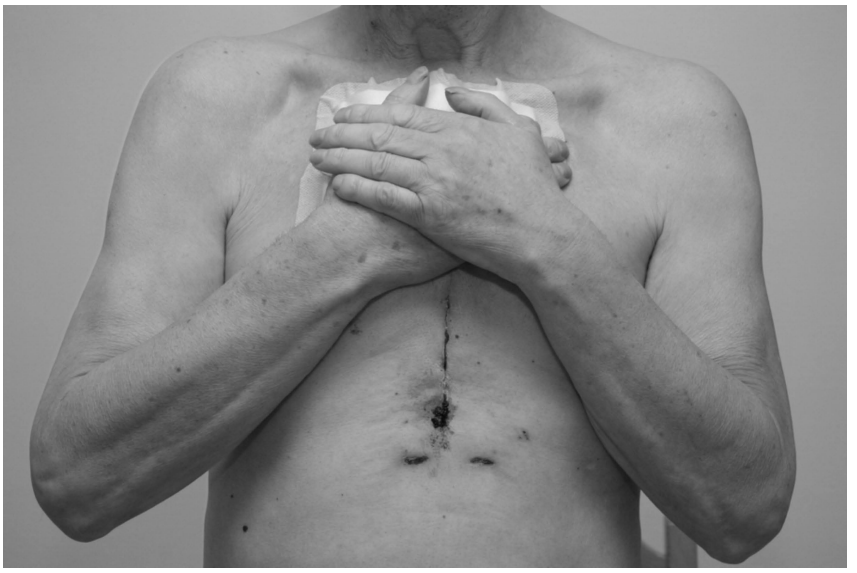
The actions undertaken during the instruction meetings aim at:

1. Teaching the patient to breathe using the upper- and lower thoracic as well as the abdominal routes. Although cardiac operations result in a trauma and expansion of the thorax and the skin and the sternum are cut, we do teach these three modes of respiration. Application of the upper- and lower respiration performed together with a support of upper limbs movements (with restriction of the flexion and abduction to an angle of 90°), favours accustoming to these movements despite the sternum wound and encourages activity. We use auxiliary materials resisting movements of the abdominal wall, such as a bag filled with sand or an ordinary bottle placed over the central part of the epigastrium. This form of the preparation is particularly important in cases of post-surgery diaphragm paralysis. Because of a possibility of such post-operation complications as: pneumothorax, atelectasis, pericardial effusion, we also teach asymmetric respiratory exercises. Abdominal respiration constitutes an inseparable element of respiratory rehabilitation and should thus be trained before the surgery.
2. Teaching the use of devices facilitating respiratory exercises, augmenting lungs vital capacity and training respiratory muscles.
3. Teaching to assume an appropriate position during cough after the operation, with sternum stabilisation, as well as teaching to properly move and change positions – use of rope-ladders by sitting down and/or standing up without excessively shifting the load onto the upper extremities, in order to prevent sternum separation.
4. Teaching an effective cough enabling expectoration of the secretion residing in the bronchi, as the most important technique of the bronchial tree toilet. Other techniques, e.g. drainage positions, are used sporadically, already in post-surgery patients, in whom they may be more beneficial than focusing only on the protection of proper sternum healing.
5. Theoretical and psychological preparation of the patient for the cardiac surgery. Kinesitherapists, as members of the therapeutic team, also participate in these activities. Kinesitherapist's role involves describing, presenting and performing the necessary set of exercises (respiratory exercises and general fitness training) that will be used during the post-operation period. The kinesitherapist also pays attention to the principles of post-surgery functioning: sternum protection, principles of moving in bed, the room and the ward. Psychotherapeutic activity of the kinesitherapist focuses mainly on reducing patient's emotional tension and motivating him to cooperate with the therapists and then regularly perform the exercises.

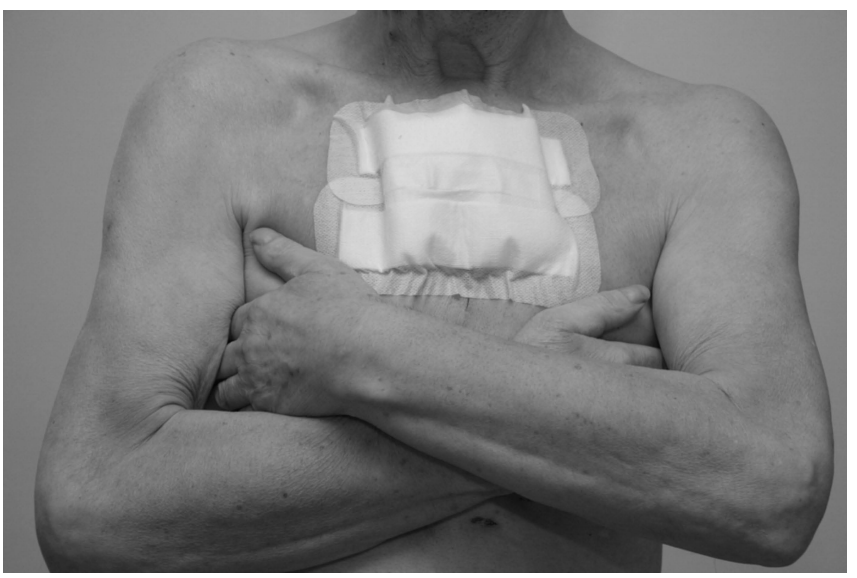
The above goals of the pre-surgery instruction meetings are achieved by:

1. Performing respiratory exercises at various positions (erect, sitting and supine) using particular respiratory routes, with cough simulation at appropriate points of time and with simulation of the protection of future post-operation wound. Sternum wound is considered the most important one. Its protection involves placing the hands on the sternum during coughing without exerting excessive pressure onto the skin (Picture 1). The second method of sternum protection during

a cough is putting the hands into the armpits – in this way, the central part of the thorax is stabilised. This method is usually used later (over 3 days after the operation), as it is a more convenient method for the many more independent patients, already assuming the erect posture (Picture 2). Use of a stabilising belt is an additional protective element, recommended especially for persons with persistent, strong cough and in overweight patients (based on our own experience, in case of these patients, this form of chest protection increases chances of sternum stabilisation – they are usually less agile in their movements, especially early after the surgical procedure; use of the belts is also recommended for women, in whom an ample bust increases the risk of separation of the sternum osteosynthesis) (Picture 3). It was noticed that use of the belts accelerates convalescence of the patients via sternum stabilisation and an increased probability of proper osteosynthesis, while the patients themselves feel safe undertaking activities of daily living and physical efforts. Determining the duration and frequency of use of the stabilising belt depends on the experience of a centre using this form of sternum protection. We recommend using the belt at night in patients, who are not accustomed to sleep on their back as well as during the day with breaks for hygiene and rest. Patients are encouraged to – after discharge from the department – apply this protection when using public transport, until the sternum is completely healed (i.e. for approx. 3 months after the operation). It should also be emphasised that these recommendations are based on own experience only; the authors are not aware of any research studies on using such form of sternum protection in the early post-operation period.



Picture 1
Protection sternum during cough, method 1



Picture 2
Protection sternum during cough, method 2

2. Teaching performance of respiratory exercises conducted by either the left or right half of the thorax.
3. Respiratory exercises using devices resisting the inspiration in order to increase lung volume (e.g. Tri-Flo II, Voldyne) or resisting the expiration, aiding in bronchial tree toilet, depending on currently available equipment (e.g. a bottle filled with water) (Picture 4).
4. General agility exercises in the erect, sitting and supine positions, intermittently with respiratory exercises that enable maintenance of general fitness, also in cases where the patient, because of a necessity to perform additional tests, will have to stay longer in the pre-operation ward. Simple, active exercises of the upper and lower limbs are applied. Their principle is to restrict upper limbs movements to the shoulder level and to restrict the horizontal abduction movement so that the patients could memorise this rule for the post-operation period, until the sternum is healed. Exercises of the joints of hands and feet are also performed. They are important in cases of post-operation oedema of the limb, which the vein for the by-pass formation was taken from, and as thrombosis prevention.
5. Simulation of the post-surgery situation and teaching of movements in bed and of independent self-service.

Picture 3
A belt stabilizing the chest, applied in persons after cardio-surgical operations

Picture 4
Tri-Flo II Inspiratory (3-Ball) Exerciser
(with permission of Tyco Healthcare Group LP USA)

To achieve this, we teach how to sit up from the supine position and to lie down from the sitting position using bed rope-ladders, while moving in bed involves so-called "walking on buttocks". We take utmost care that – immediately after the operation, to stabilise the sternum – patients do not change their positions abruptly during self-service, do not bend with the head down, and do not reach too far with the arm, crossing the body half.

6. Information for / teaching the patients the structure and function of the cardiovascular system, the specificity of the operation to be performed and the importance of use of the above therapeutic methods. Stress coping strategies are also presented. The whole team is engaged in this task: the physician, the psychologist and the physiotherapist.

During this phase of pre-operation management, we sometimes come across problems that require a separate approach or introduction of additional therapeutic elements. These special problems may refer to patients, who have:

- faulty posture or joints movements restriction (planning exercises correcting and increasing joint mobility will be needed),
- chronic respiratory system diseases, e.g.: COPD (planning specific physiotherapeutic management),
- hearing and vision disturbances (individual preparation of the patient),
- impaired cognitive and intellectual skills (adjustment of the conveyed information to patient's abilities).

Persons admitted as urgent cases constitute a separate group of "problematic" patients. Due to the lack of pre-surgery preparation possibilities, the education should be delayed until the early post-operation period, when the information should be gradually conveyed during exercises with the patients so as not to overwhelm them with excessive new information.

Early rehabilitation – phase I – intensive care unit

After cardiosurgical operation, the patient is transferred into the intensive care unit, where he remains for approx. 1–2 days and where he is subjected to kinesitherapy in a 24-hour system. At night, the physiotherapist on duty is to work with the patients operated on the same day and extubated during evening-night hours. Therapeutic activity involves respiration exercises varying according to the degree of contact with the patient. With drowsy patients, we perform breathing facilitating manoeuvres using the effects of sensory and verbal stimulation. To perform this, the therapist's hands are placed on both sides of the thorax, along the ribs deepening the inspiration on the command: "please, breathe in". Expiration resisting exercises using a bottle filled with water or blowing onto a sheet of wood-wool as an element diversifying the therapy and facilitating cooperation with the physiotherapist are also used. Respiratory exercises are conducted for a period of 30 minutes. After this time of intensive respiration exercises, according to general recommendations, gasometry and haemoglobin saturation are checked[2,3].

The aims of the early post-surgery phase I rehabilitation, designed and used this way, are:

- extubation of the patient at an appropriate time for him, without unnecessarily postponing this procedure until the first post-operation day,
- smooth and rapid regaining the contact with reality,
- restoration of normal values of gasometric parameters,
- improvement of respiratory muscles function, including the diaphragm,
- evacuation of the residual secretion,
- prevention of pneumonia and atelectasis,
- prevention of thrombo-embolic changes,
- prevention of a possible re-intubation,
- rapid patient's mobilising,
- shortening of patient's stay in the intensive care unit, which implies lower costs of the whole therapy.

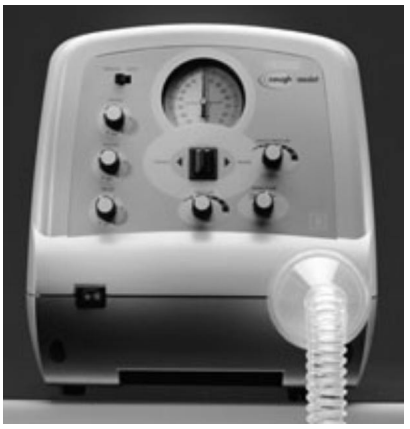
Achievement of the above, particular goals is possible owing to the following physiotherapeutic methods:

- Verbal stimulation therapist-patient and sensory stimulation in a form of respiration facilitating manoeuvres (as above) used in the awakening patient, still ventilated using a respirator. The device is functioning in the CPAP mode (continuous positive airway pressure; this is one of the available respirator functions used as a standard before the extubation).
- Monitoring gasometry parameters, as oxygen and carbon dioxide partial pressure in the blood is one of the crucial parameters for the physician to decide to disconnect the patient from the respirator. Upon deciding on disconnecting from the respirator, patient's consciousness level and the degree of logical contact with the patient are also taken into account. These include reaction to voice, comprehension of words directed to him, performing simple tasks, such as e.g. clasping the hand like during welcoming.
- Rapid extubation of the patient associated with respiration therapy conducted for the first 30 minutes following extubation and finished by laboratory assessment of gasometry and haemoglobin saturation (normal values: $pO_2 > 80$ mmHg, pCO_2: 35–45 mmHg, $SaO_2 > 95\%$). During the respiratory exercises, saturation of haemoglobin with oxygen is continuously monitored, which enables appropriate evaluation of patient's clinical status and the effectiveness of the performed exercises. If patient's contact with the environment is limited, the BIPAP Vision device can alternatively be used (Picture 5). It is a type of respirator that serves to facilitate breathing non-invasively by administering the air under a positive pressure. The device may operate in three modes:
  1) continuous positive airway pressure – CPAP,
  2) pressure-supported ventilation – S/T (pressure support),
  3) assisted ventilation – PAV/T (proportional assist ventilation).
- Applying ice massage of the back along the spine and intervertebral spaces. This, based on a reflex mechanism, results in deep inspirations, which is very useful in drowsy patients.
- Use of respiratory exercises by a selected route, dependently on patient's cooperation. Conduction of respiratory exercises assisted by upper limbs movements – up to the shoulder level, visual constraint of deep breathing by means of ball-devices, a bottle with water or a wood-wool sheet.
- Inhalations with addition of mucosolvants and bronchodilators.
- Beating and manual vibration during expiration, as well as use of devices facilitating secretion evacuation, e.g. Cough Assist device (Picture 6). It is a device for non-invasive respiratory pathways clearing of mucous blockades based on formation of pressure gradient. Its use enhances natural mechanisms of evacuating the secretion retention.
- Trials of effective coughing during the intensive respiratory exercises at a prolonged or intermittent expiration.
- Rapid, step by step assumption of the erect posture and mobilising the patient while pleural drains are still placed and at optimal drugs infusion rates. This is achieved by: sitting-up in bed from the supine position using a bed rope-ladder, sitting in bed with the legs lowered, standing by the bed, and assisted walking in the ward. The rate of this process depends on: ECG curve (no dysrrhythmia), HR (100 beats/minute at maximum), pressor agents dose (mobilisation may be continued if the doses are not greater than 5 μg/kg/min.
- Anti-thrombosis exercises of the lower limbs – active slow exercises of the feet and flexion in the relieved knee and hip joints.
- Active slow exercises of the upper and lower extremities joints with limiting loading them with body weight, for the prevention of loosing fitness and of contractures. Special precautions are necessary – upper limbs exercises up to the shoulder level for the protection of the clamped sternum, not too abrupt movements of the extremity (upper or lower), which a vein for the by-pass was taken from, monitoring of heart rate, blood pressure and saturation measured using a pulseoximeter.
- Frequent changing the position in bed.

Picture 5
BIPAP Vision
(with permission of RESPIRONICS)

At this stage of therapy, special caution should be exercised:

– so that, during switching the patient to the CPAP function, together with elevating the patient higher in the sitting position and monitoring gasometry, there is a constant logical contact between the patient and the therapist; patient's reaction to touch should also be controlled for; when needed, breathing facilitating manoeuvres should be applied;
– when deciding on assuming by the patient the upright posture, check-up of drugs infusion rates, ECG, HR, BP, saturation is inevitable as well as discussing the issue with the attending physician;



Picture 6
Cough Assist
(with permission of J.H.EMERSON)

– it is also important to monitor and adjust the therapy to gasometric parameters. If pCO_2 is above, and pO_2 and SaO_2 below normal limits, we intensify the respiration therapy; if patient's general condition is that poor that exercises are ineffective, assisted respiration using the BIPAP Vision device is used, and – in severe cases – re-intubation is performed (decision on further management is made by the physician).

In the first phase of early rehabilitation, patients with post-surgery psychosis are a serious problem for physiotherapists because of a very limited possibility to exact the commands. Passive oxygen therapy or the BIPAP Vision device are used in such cases.

Early rehabilitation – phase II – the patient treated in the post-operation ward

The next step in the healing process involves transferring the patient from the intensive care unit to the post-operation ward, where the patient most frequently stays for 3 to 4 days.

Aims of this phase are:

– further permanent and intensive patient's mobilisation,
– gradual restoration of the thoracic route of breathing,
– reinforcing the postural and respiratory muscles,
– increasing physical endurance after the post-surgery immobilisation and the reduced activity in the ICU,
– expanding patient's independence,
– breaking patient's psychological resistance regarding the exercises,
– encouraging full independence in self-service and every-day activity,
– initiation of the programme of healthy lifestyle promotion and secondary prevention.

Methods enabling the achievement of the above aims are:

- General fitness training in the supine, sitting and standing positions in a gymnastic hall or in the ward (depending on patient's general condition).
- Conduction of individual respiratory exercises at various positions and obturative respiratory exercises (use of devices resisting inspiration and expiration, placing sand-filled bags or a bottle with water onto the central part of epigastrium during diaphragm respiration).
- Exercises of effective cough supported by beating and springing of the thorax as well as by drainage positions.
- Independent or assisted walks at gradually increasing distances, using cycloergometer and walking on a stairway (distance length and effort load depend on the attending physician's decision). Cycloergometer exercises are recommended for the patients beginning with the second day after removal of the flow drainage (that is usually the 4^{th}–5^{th} day after the cardiac surgery), when they are able to maintain the standing position and move independently within the post-operation ward. Lower extremity wound healing in patients after coronary artery by-pass grafting is taken into account (the limb should not be reddened, excessively warm, and there should be no dripping from the wound). The most frequently used initial workload is 25 Watts, and session duration does not exceed 5 minutes. Intensity and duration of the effort depend on patient's general feeling (especially on fatigue that must not exceed 6 in a 10-point Borg scale) and heart rate (maximum allowed HR increase is an increase by 20% of the baseline heart rate). During cycloergometric exercises conducted as a part of kinesitherapy, a workload of 75 Watts is not exceeded. In the patients, for whom a workload of 25 Watts is too large, bicycle ergometer training without load is introduced.
- Instructions given verbally or by means of information leaflets elaborated for the patients on how further healing and the return to active life should proceed. The information conveyed pertains to the methods of sternum protection (e.g. use of chest stabilising belts, not-loading the upper extremities with weights greater than 5 kg during the first 2 months and a necessity of possibly symmetrical weight distribution on both arms, avoiding activities associated with a large isometric effort component), to the care of proper post-operation wounds healing. It is emphasised that at least 20 minutes of physical effort non-associated with every-day functioning should be introduced to the daily schedule (e.g. slow bicycle riding or short-distance walks). As early as in this phase of the rehabilitation, patients are encouraged to correct their culinary habits.
- Conduction of the therapy in a shift-work system, thanks to which, the patients are under physiotherapists' care 24 hours a day.

At this stage of the rehabilitation, it should always be born in mind that:

– performance of the exercises should be preceded and followed by taking a history of patient's current general feeling and heart rate and blood pressure measurements,
– each session of kinesitherapy in patients, in whom episodes of cardiac arrest, heart dysrrhythmia or syncope had occurred, should be conducted after discussing it with the attending physician.

At this point of time, specific physiotherapy used directly after the cardiac surgery procedure is completed. Further physical therapy is conducted according to general principles of cardiac rehabilitation. After cardiosurgical operations, patients are transferred to departmental centres for early rehabilitation, where they are introduced

into the kinesitherapeutic system according to a model appropriate for their health status. It is, therefore, the next phase called post-hospital departmental rehabilitation, where the following activities take place:

– qualification of the patients for further treatment and rehabilitation, based on the results of the graded exercise test and depending on concomitant diseases (dysrrhythmia, arterial hypertension, diabetes mellitus, amputations, pareses, paralyses, age),
– continuation of the kinesitherapy started in the hospital,
– endurance training,
– more and more independent functioning in conditions similar to those of every-day life.

The programme of post-cardiac surgery patients' rehabilitation, designed in the Cracow Department, is not limited solely to the pre- and early post-operation kinesitherapy and is not terminated with patient's discharge to the post-hospital rehabilitation centre. For persons living in Cracow or its neighbourhood, who underwent cardiac surgery, also outpatient rehabilitation is planned. It is conducted in the gymnastic hall situated in the Department and includes:

– training increasing / maintaining physical endurance by group therapy in the gymnastic hall, using cycloergometers, treadmill, steppers and other available gymnastic instruments and accessories (mattresses, ladders, bands, balls),
– popularising and encouraging a change of eating habits, an active lifestyle based on recreation and acquiring / fathoming the knowledge of health protection by holding lectures collecting persons after cardiosurgical operations,
– organising people who underwent cardiac surgery procedures into a support group in the SONS Patient's Club (Post-Cardiovascular Surgery Patients Society).

Specific problems during the course of rehabilitation

Our work experience in the cardiovascular surgery ward is associated with patients after various types of operations. The largest group among our patients are the patients with coronary artery by-pass grafts and after valvular reconstructive or replacement surgery (aortic, mitral, tricuspid), and also after heart transplantation. Infrequently, there are patients after thoracic and abdominal aortic aneurism operations, endartherectomy and correction surgery of congenital heart diseases.

The above kinesitherapeutic management can be applied in the majority of the listed surgery types. It is, however, worth emphasising several exceptions in the rehabilitation course:

- In case of valvular surgery, there are no restrictions associated with an additional limb wound. Thus, we may more intensively engage the extremities during the exercises.
- In patients with heart transplantation, all phases of the post-surgery rehabilitation are conducted in the Transplantation Ward. The kinesitherapist must especially keep in mind the aseptic principles (protective caps, masks, gloves and aprons). The patient stays at the Department until the engraftment, that is approx. 1–2 months. Therefore, we have a possibility to dissociate in time and supervise the rehabilitation process for a longer period of time. During the late post-operation period, we use the above mentioned therapeutic procedures with a more intensive effort. Kinesitherapeutic management is related to myocardial biopsy results (which inform about the degree of a possible rejection of the transplanted heart), 24-hour ECG monitoring by means of the Holter method and the ejection fraction assessed in the echocardiography.
- In patients after thoracic aorta aneurism surgery, clapping should not be used during the early post-operation period.
- In patients after abdominal aorta aneurism surgery, we use primarily the diaphragmatic respiration route. During coughing, attention is paid to stabilising the wound in the abdominal region.
- Post-endartherectomy patients do not start assuming the upright position for the first two days. The decision as to this issue is made exclusively by the attending physician.
- Patients after implantation of iliofemoral prostheses, in the first 2–3 days, are secured from performing flexion movements in the hip joints, as well as we resign on elevated sitting.

Discussion

A planned and systematically conducted rehabilitation process used in cardiac surgery is positively confirmed in the studies conducted in our Department among post-coronary artery by-pass grafting patients[4,5]. Results of these studies indicate that combining surgical treatment with swiftly and comprehensively planned rehabilitation is necessary for good functioning of cardiovascular surgery centres that – apart from the main goal, which is the good outcome of patient's treatment – finally aim at patient's good quality of life. Such approach and similar results can also be found in many other studies by authors working in this field[6,7,8,9,10,11].

Comparing the rehabilitation techniques used by ourselves with the recommendations published in the liter ature[7,12,13,14,15,16,17,18], as well as with proceedings of the last two scientific meetings on cardiac rehabilitation that took place in Katowice and Ustroń[19,20], it should be emphasised that general kinesitherapeutic preferences are similar. A treatment protocol emerges from these data that aims primarily at a rapid restoration of patient's optimal health status. It is equally important for the comprehensive rehabilitation to ensure not only satisfactory physical endurance enabling the patient a better than before operation and independent functioning, but also to ensure a return to his social roles, possess abilities of relaxation and coping with stress. The education aiming primarily at secondary prevention, is not less important. Its effect involves introduction by the patients themselves the principles of healthy eating habits, ceasing to smoke cigarettes, better adaptation to new conditions after the operation, returning to sexual activity and to work[7,8,21,22,23,24,25,26].

Pasquali et al.[27] notice the problem of a less active participation of the elderly in the post-operation rehabilitation. The presented studies prove that participation of both the younger and the older patients may be augmented by effective education. The problem of a smaller interest in physical exercises as one of the forms of comprehensive rehabilitation is not supported in case of our Department, as members of the SONS Club, mostly the elderly, very willingly participate not only in educational meetings, but also in systematic gymnastics conducted twice a week.

Comparing rehabilitation procedures used in the western countries with those used in our Department and pertaining to the early post-operation therapy, the necessity of early extubation and the intensive respiratory rehabilitation introduced immediately after disconnecting the patient from the respirator can be confirmed. This allows to shorten patient's stay in the intensive care unit[7,9,10,16,28].

Studies conducted in other European countries confirm the benefits of comprehensive rehabilitation. The most frequently listed benefits include: improved lung ventilation, ensuring appropriate gas exchange, achievement of independence and self-sufficiency in every-day activities, counteracting the effects of immobilisation, increasing muscle strength and mass, health amelioration, improvement of quality of life, better general feeling, improvement in physical endurance, alleviating myocardial ischaemia, slowing progression and even reversal of atherosclerosis, reducing disability, minimising complications, reducing the costs resulting from the hospitalisation and shortening treatment duration, as well as reducing mortality[7,9,10,14,15,16,26,29,30].

Taylor-Piliae[8] enriches the traditional cardiac rehabilitation with Tai Chi elements. The technique widely practised in China is a popular form of health exercises, famous because of cultivating styles of longevity and health. Mikula[12] proposes enriching the respiratory rehabilitation with elements of Chinese and Indian medical traditions. In the Department of Cardiovascular Surgery and Transplantology, we are also trying to introduce new elements. We, therefore, aside the standard kinesitherapeutic procedures, also use: ice massage, reflectoric massage, components of the PNF method, the NDT-Bobath for adults and music therapy.

Summary

To summarise the considerations on the issue of the peri- and early post-operation rehabilitation, based on our own experience and the data from the literature, it should be ascertained that it constitutes an inevitable and integral part of the invasive treatment of cardiovascular diseases.[31–37] This rehabilitation facilitates awakening and rapid extubation of the patients and is an element of prevention of thrombo-embolic complications. It facilitates healing and – by promoting pro-salubrious behaviours – should be a continuous process lasting lifelong. It enables identification and modification of risk factors for cardiovascular diseases, has positive medical and socio-economical effects. Therefore, its components should not only involve physical therapy, but also health education as well as monitoring its effects via evaluation of the quality of life of the patients participating in this therapy. Kinesitherapy in the cardiac rehabilitation, owing to requirements imposed currently to each comprehensive rehabilitation, also has chances to work out novel methods of helping the patients[7–12,24,25,29,30,38].

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